

reaction increases the rotational force. The same process takes place at each of the successive rings of guide and moving blades. The energy to give the steam its high rotational velocity at each successive ring is supplied by the drop in pressure, and the steam expands gradually by small increments. In a moderate-sized turbo-motor there may be from thirty to eighty successive rings, and when the steam arrives at the last ring the expansion has been completed. On the left side of the steam inlet *J* are the driving or rotating pistons, which are fixed to and rotate with the shaft. On their outsides are grooves and rings, which project into corresponding grooves in the case. By means of the thrust bearing of the motor the longitudinal position of the shaft is adjusted and grooves and projecting rings kept nearly touching, so as to make a practically tight joint. The object of these pistons is to steam balance the shaft and relieve end pressure on the thrust bearing. Fig. 3 shows a 350 kilowatt turbo-alternator, thirteen of which size are now at work in the London stations.

With compound condensing turbines a steam efficiency comparable with the best compound or triple expansion condensing engines was at length reached, and it was

of 32½ knots, and the maximum speed so far obtained has been about 35 knots.

It is anticipated that this turbine engine can be successfully applied to all the faster class of vessels, including those of the largest size; in fact, it appears that the relative advantages are greatest in the largest sizes.

NOTES.

THE new Government Laboratory, which has been about two years in course of erection, is now completed, and will be formally opened to-morrow (October 1). We hope to be able to give a description of the building in our next issue.

THE Paris correspondent of the *Times* states that an anniversary service was held on Tuesday at the Pasteur Institute in honour of the great investigator. A number of his disciples and the members of his family who are in Paris assembled in the crypt of the Institute at his tomb, and placed upon it garlands of flowers from the Garches gardens. The subscription for the Pasteur monument now exceeds 300,000 francs.

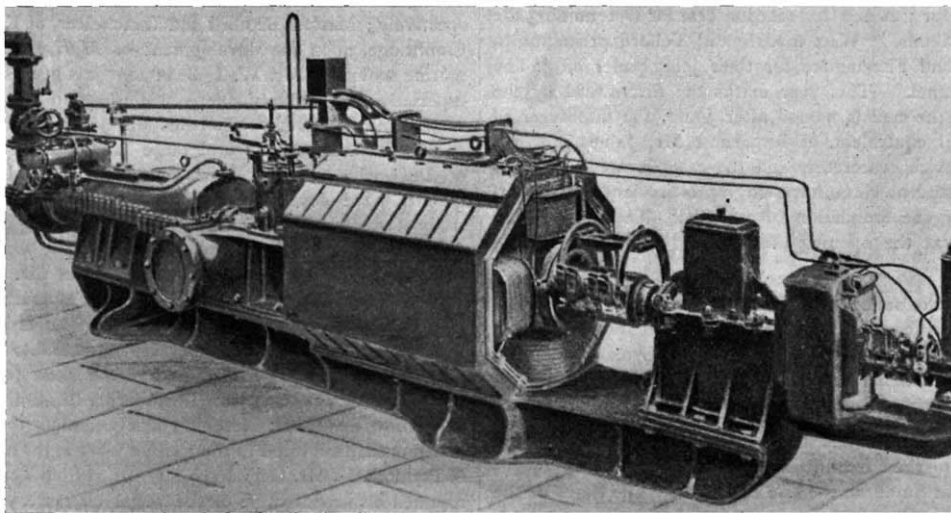


FIG. 3.—A 350-kilowatt Alternator and Turbine.

then resolved to test the application of the turbine to the propulsion of ships, for which purpose it seemed well suited, provided that as good an efficiency could be obtained from fast running screw-propellers as with ordinary ones, and to test the system it was determined to build the *Turbinia*, which is 100 feet in length, 9 feet beam, and 44½ tons displacement. One compound condensing turbine engine of 2000 I.H.P. was at first fitted, but it was found that long before this power was developed the screw began to tear the water, forming vacuous spaces and vortices behind the blades, and causing great loss of propulsive effect. The single large engine was then replaced by three separate ones, high pressure, intermediate pressure, and low pressure, each driving a screw shaft at the same speed of rotation as before; but the blade area was by these means trebled, and this trouble ceased. The efficiency of the screws approached closely to the best results of ordinary screws. The *Turbinia's* engines are similar to those for the driving of dynamos described, but they are necessarily larger and of lighter construction, and the expansion of the steam is carried to 170-fold at full speed. Prof. Ewing's tests have shown a consumption of 14½ lb. of steam per I.H.P. at a speed

AN epidemic of typhoid fever has broken out at Maidstone, Kent. More than nine hundred cases have been notified, and up to Tuesday night twenty-one deaths from the disease had occurred since the beginning of the outbreak. The epidemic is due to polluted water, and is confined to the area of the town supplied with water from springs at Farleigh, all of which have been condemned by the medical officer of health.

It is much to be regretted that the splendid male Giraffe, presented to the Queen by the Chief Bethoen, of Bechuanaland, died so soon after reaching this country. The difficult task of bringing it home was entrusted by the Colonial Office to the Zoological Society, who selected for the work one of the most experienced men in Europe in moving large living animals—Herr Windhorn, of Alfeld. The Giraffe was led from Kanya to Lobatsi by road, and safely lodged at the railway station in a box, which had been specially constructed for it at Cape Town. It was placed on board the s.s. *Roslin Castle* (in which a free passage had been most liberally granted to it by Sir Donald Currie), and left Cape Town on September 1. The passage was a stormy one, and after the first week the Giraffe declined to eat anything but bread. A few days later it left off feeding altogether,

in spite of every attempt of its experienced keeper to induce it to eat. It was therefore, on reaching London, nearly dead from exhaustion, and only lived for half an hour after its arrival in the Regent's Park, where it was proposed to keep it for the winter. This event is the more to be lamented, as the fine young female already in the Society's Gardens (which was also brought to England from the Cape by Herr Windhorn) thus remains still without a mate, and there is at present little prospect of obtaining one.

AMONG the prizes awarded by the Institution of Civil Engineers for the session 1896-97 are the following :—The Howard prize of fifty guineas to Mr. H. Bauerman, in recognition of his work on the metallurgy of iron. For original papers presented to the institution, Telford medals, with premiums of books or instruments, to Messrs. H. A. Humphrey, for "The Mond Gas-Producer Plant and its Application"; to Colonel Penny-cuik, R.E., for "The Diversion of the Parivar"; to Mr. E. C. Shankland, for "Steel Skeleton Construction in Chicago"; to Mr. Dugald Drummond, for "High Pressure in Locomotives"; and to Mr. Thomas Holgate, for "The Enrichment of Coal Gas." George Stephenson medals and Telford premiums to Mr. Crutwell, for "The Tower-bridge Superstructure," and to Prof. Unwin, for "A new Indentation Test for Determining the Hardness of Metals." Watt medals and Telford premiums to Messrs. Hay and Fitzmaurice, for their joint paper on "The Blackwall Tunnel." This year marks the first award by the Institution of the medals named after Joule, the discoverer of the mechanical equivalent of heat, and Mr. James Forrest, whose long service as secretary and the care devoted by him to fostering the student class, have on his retirement been commemorated by the foundation of a medal. The presentation will be made at the opening meeting of the new session on November 2.

THE deaths are announced of Dr. August Mojsisovics, Edler von Mojsvar, professor of zoology and comparative anatomy in the University of Gratz; Mr. Theodore Lyman, honorary member of the National Academy of Sciences; and Dr. Welcker, for some years professor of anatomy in the University of Halle.

PROF. JOHN MILNE has shown us the photographic tracings of two well-marked earthquakes, recorded last week by his seismographs at Shide, in the Isle of Wight. The times of the disturbances are September 20, 7.30 p.m., and September 21, 5.30 a.m. The duration of each disturbance at Shide was about three hours, and the preliminary tremors extended over about forty minutes, from which facts Prof. Milne concludes that the place of origin was at least six thousand miles distant.

MR. N. L. BRITTON has been elected President, and Mr. J. C. Arthur Vice-President, of the Botanical Society of America for the coming year.

WE learn from the *Botanical Gazette* that the Smithsonian Institution, Washington, has undertaken an important work in bringing together all possible material bearing on the medicinal uses of plants in the United States. Dr. V. Havard is chairman of the commission for this purpose.

MR. WILLIAM WESLEY WOOLEN, of Indianapolis, has announced his intention of presenting to that city a tract of land, consisting of fifty-six acres, for the purpose of establishing a botanic garden and an ornithological preserve.

PROF. J. P. O'REILLY sends us some extracts from a work on Morocco ("An Account of the Empire of Morocco," by James Grey Jackson, 1814), containing an account of the use of olive oil as a remedy for a form of plague which depopulated West Barbary in 1799-1800. The oil was used to anoint the skin, either before or after infection. Prof. O'Reilly points out that

the ordinary olive oil of the Levant and of Spain is not the pure clarified oil we know of in this country, but a green and generally more or less rancid oil produced in a coarse way from all sorts of fruit, unsound as well as sound.

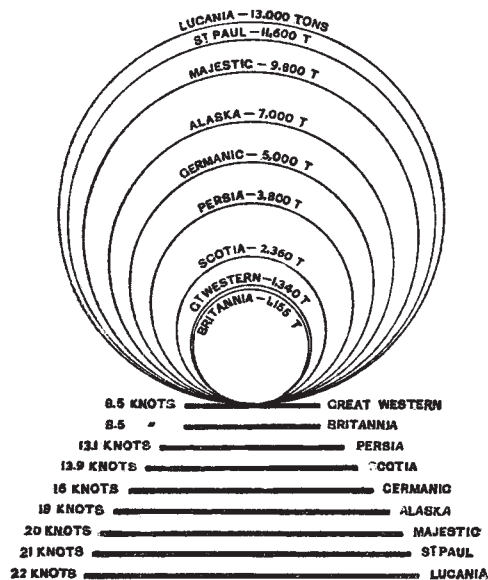
THE October number of *Science Progress* will contain articles on "Some Physiological Aspects of Hypnotism," by Prof. F. Gotch, F.R.S.; on "Artificial Flight," by Prof. G. H. Bryan, F.R.S.; on "Progress in the Study of Variation," by Mr. W. Bateson, F.R.S.; on "Blood and the Identification of Bacterial Species," by Dr. Grunbaum; on "The Fauna of the Great African Lakes," by Mr. J. E. S. Moore.

DURING the past summer full advantage has been taken of the facilities for research afforded by the Plymouth laboratory of the Marine Biological Association. Prof. Weldon has carried out an interesting experimental inquiry into the selective action of different conditions in the case of *Carcinus menas*. Mr. S. D. Scott has studied the physiology of excretion in certain Ascidians, Dr. Lubbock the anatomy of various fishes. Dr. G. Duncker, of Kiel, is at work upon the racial characteristics and variation of Pleuronectids and other fishes; Mr. Taylor, upon Polyzoa; Messrs. E. T. Brown and Jenkinson, of University College, London, upon Medusae and larval Crustacea respectively; Messrs. Bedford and Lanchester, of King's College, Cambridge, upon the development of *Myriothele* and general marine zoology. Mr. W. I. Beaumont has been studying more especially the Nudibranchiate Mollusca and Nemertinea, and some rare captures have rewarded his exertions, notably several specimens of *Hancockia* and large *Lomanotus*. Mr. Brebner, of University College, Bristol, and Mr. A. H. Church, of Oxford, have devoted much attention to the collection and study of marine algae. In spite of the inclemency of the weather during August, the steamboat *Busy Bee* has been in constant requisition throughout the summer. Under Mr. Holt's charge a prolonged visit was paid in July to Falmouth, where Mr. Rupert Vallentin and Mr. J. T. Cunningham assisted the staff, and much valuable material was accumulated. The rare dragonet *Callionymus maculatus* and the interesting Anthozoan *Gonactinia prolifera* were obtained during this cruise. Trawling expeditions under Mr. Holt have also been made to Exmouth and Dartmouth, in addition to the routine work in the neighbourhood of Plymouth. Mr. Garstang has returned from Toronto, and has resumed his investigation of the racial characters and variation of the mackerel, for which purpose a large number of fish has been received from H.M. Inspectors of Irish Fisheries. In connection with the food-supply and migrations of pelagic fishes, Mr. Garstang is also investigating the seasonal changes and distribution of the plankton, and has brought back with him two series of collections of the surface plankton of the North Atlantic, obtained during his recent voyages from Liverpool to Quebec *via* the North of Ireland, and from Philadelphia to Queenstown along the edge of the Gulf Stream. Interesting results are expected from the comparison of these collections of "pump-plankton." The Marine Biological Association's exhibit, which proved so attractive a feature of the recent fisheries exhibition at the Imperial Institute, has been returned to the laboratory, and has been temporarily set up again in the students' lecture-room.

PROF. R. C. CARPENTER, professor of engineering science in Cornell University, has (says *Engineering*) been conducting an elaborate set of experiments on bicycle friction which have led him to the conclusion that no form of gearing can possibly equal the best chain for efficiency and durability. With such the frictional loss has been found to be between $\frac{1}{2}$ and $\frac{3}{4}$ per cent. of the total power transmitted, this result being obtained with a chain which had previously been ridden more than 2000 miles with a rider weighing about 14 stone. With some other

chains less well constructed, a greater loss has been found, the friction lying generally between 2 and 5 per cent.; the maximum shown, even by an old chain which did not fit its sprocket properly, was under 10 per cent. No bevel gears as yet constructed give as good results as these, and Prof. Carpenter concludes that with even the best bevel-gear bicycles the loss must be four times as much as with the ordinary chain, and six times as much as with the best chain. Moreover, as has been previously pointed out, gear wheels to work well must be in very accurate adjustment with each other, whilst with a chain no such careful fitting is required.

THE current number of *The Engineering Magazine* contains an instructive illustrated article, by Mr. Ridgely Hunt, on fifty years of advance in marine engineering. The accompanying diagram, reproduced from our contemporary, shows at a glance the increase of tonnage and speed during the last half-century. In this period iron and steel have supplanted wood, and, says the author, "engines have advanced from simple to compound, and then to triple-expansion; so, too, have paddle-wheels been discarded for single-propellers and for twin-propellers; so, too, have single rectangular boilers with one flue, been replaced by several boilers, cylindrical, and with many tubes; so, too, have



jet condensers been transformed into surface condensers, and the steam pressures have been raised from 10 to 100 and 200 pounds to the square inch. The size of steamships has been multiplied twenty-fold, and the horse-power forty-fold. The speeds of the ships have been increased from 8 to 17 and 23 knots; and in every other respect has there been a like extraordinary evolution." How the conversions have been effected is briefly described in Mr. Hunt's interesting paper.

A VERY brilliant aurora observed on April 20 in lat. $47\frac{1}{2}^{\circ}$ S., by Captain M. W. C. Hepworth, was briefly described in our notes on June 24 (p. 183). Mr. T. F. Claxton, the director of the Royal Alfred Observatory, Mauritius, sends us an account of magnetic disturbances apparently connected with the aurora display. He says that on the day of the aurora a rather large magnetic disturbance was recorded at the observatory. "From June 20d. 9h.-19h. the horizontal force decreased '01578 m.m.s. units. From 20d. 12 $\frac{1}{2}$ h.-19h. the vertical force increased '00336 m.m.s. units, and the declination, from 20d. 9 $\frac{1}{2}$ h.-13h., decreased 9'2, and from 13h. to 19h. increased 7'0. The most active period was from 20d. 17h.-20h. The magnets

were quiet from 21d. 0h.-23d. 10h. 16m., when a sudden decrease of horizontal force, vertical force, and declination occurred to the extent of '00258, '00056 m.m.s. units, and 1'0 respectively. In horizontal force the decrease continued till 23d. 21 $\frac{1}{2}$ h., and amounted to '01204 m.m.s. units, while the disturbance in vertical force was very small."

THE report of the Central Meteorological Office of France for the year 1896, shows a large amount of work performed, and is very creditable to the staff of that institution. One of the principal services rendered consists in predicting the approach of storms for one or two days in advance. Out of thirty-four storms which reached the French shores, thirty-one, or 91 per cent., were foretold. This satisfactory result is, to a considerable extent, due to the fact that the great majority of these disturbances cross the British Isles, notice of which is regularly telegraphed to Paris by the Meteorological Council. The number of telegraphic reports received daily amounts to 167, some of which are from America, and include observations received from the fast trans-Atlantic steamers. In the department of climatology, reports are received from 211 places, in addition to a very large number of rainfall stations, and the results and discussions are published in three large quarto volumes yearly. In addition, monthly returns are received from about fifty foreign stations, as well as a large number of ships' logs. Particular attention is also paid to the collection of observations made at mountain stations, as well as by means of balloons and kites. The observation of clouds has formed a special feature during the past year; between July 1896 and April 1897, M. Teisserenc de Bort has taken no less than 2500 photographs of clouds at his observatory at Trappes, and by this means the heights of 750 have been determined.

WE have already had occasion to direct attention in our columns to the ingenious experiments conducted by Messrs. Nuttall and Thierfelder on the possibility of animal life being carried on in the absence of bacteria in the digestive tract; the third memoir on this subject by these gentlemen has now appeared in the *Zeitschrift für physiologische Chemie*, Bd. xxiii., 1897. In their previous experiments guinea-pigs were selected as subjects for experiment, but it not unnaturally occurred to the authors that chickens would be more suitable, inasmuch as they might remove some of the great difficulties which attend the procurement of the former animals in an aseptic condition from their birth. Accordingly, a few hours before the chicken was due to be hatched some eggs were carefully washed outside with corrosive sublimate and hydrochloric acid, to remove all external germ-life, and were then placed in the sterile apparatus devised by the authors, and employed in their previous experiments. But, despite the most careful manipulations, bacteria obtained access to the apparatus and spoilt the observations. There was only one conclusion to be drawn, which was that the egg-shells of the hatched chickens were responsible for the mischief. Accordingly careful examinations of eggs were made, with the result that in every instance bacteria were found on the inside of the shell. The authors conclude that bacteria are present in the oviduct before and during the formation of the shell, and become attached to the membrane of the shell. This unlooked-for and, from the experimental point of view of the investigators, unpropitious discovery has led to the abandonment of chickens for the purpose of these observations, and the authors do not announce any further intention of pursuing their interesting researches.

CULTIVATORS in many regions of the globe will be interested in what appears to have been a successful series of locust-destrorying experiments carried out in Natal, a report of which has been published in that colony as a Government notice. From a note in the *Times*, it appears that all attempts to suppress the

locust scourge there have proved only partially successful, with the exception of the plan of poisoning with arsenic, which, it is asserted, has met with absolute and unqualified success. The mixture used is prepared by heating four gallons of water to boiling point, and then adding 1 lb. of caustic soda. As soon as this is dissolved, 1 lb. of arsenic is added, after which the liquid is well stirred and boiled for a few minutes, care being taken that the fumes are not inhaled. When required for use, half a gallon of the liquid is added to four gallons of hot or cold water, with 10 lb. of brown sugar. A still better preparation is made by adding half a gallon of the poisonous liquid to five gallons of treacle. Maize-stalks, grass, &c., dipped in the mixture, are placed along the roads and in the fields, and the material can also be splashed with a brush upon anything which the locusts are known to have a liking for. Attracted by the odour of the sugar or treacle over a distance of as much as 100 yards, the locusts will eat of the mixture and die. These are eaten by other locusts, and in a few days' time the ground may become strewn with the dead bodies of the insects. With ordinary care no risk of poisoning any human being is incurred, whilst the small quantity of the material on a piece of grass or maize-stalk is said to be insufficient to injure stock of any kind—fowls have been known to feed without injury on the arsenic-destroyed locusts. The evidence adduced indicates that "hoppers," however numerous, can be destroyed in a few days, and the crops thus saved from their ravages.

Petermann's Mittheilungen promises accounts of much important geographical work recently done in Asia. M. de Déchy has explored some interesting and little-known districts of the Caucasus. Dr. Sven Hedin is to publish (in the *Mittheilungen*) a series of articles on the Mustagh-ata, the Deserts of Eastern Turkestan, the Lob-Nor problem, and on Northern Tibet. The Hungarian geologist, Dr. Eugen von Chonoky, has made some progress with an investigation of the hydrography of the great plain of China.

SIGNOR FRANCESCO CHINIGO contributes, to the *Bollettino della Società Geografica Italiana*, a note on the salt deposits of Lungro, on the slope of the Calabrian Apennines. The deposits have been worked to a depth of 220 metres, and probably extend to a much greater distance below the surface. Analyses show a composition of 97.7 per cent. of sodium chloride, the principal other constituent being sodium sulphate. The output is at present much restricted, chiefly on account of deficient railway communication, but there is no real obstacle to prevent these deposits supplying the whole of Italy with salt of the highest quality.

THE *Zeitschrift der Gesellschaft für Erdkunde zu Berlin* contains a short summary, by Dr. Carl Sapper, of available information about the first campaigns of the Spaniards in Northern Central America. The material at hand is in many respects unpromising, many accounts are directly contradictory, and there are traces of much priestly interference with the documents; but a good deal can, nevertheless, be made out with fair chances of accuracy. Dr. Sapper shows on a sketch map the courses of Francisco Hernandez (1517), of Juan de Grijalva (1518), and of Ferdinand Cortes (1519) by sea, and the land routes of Ferdinand Cortes (1524-25), of Pedro de Alvarado (1524), of Luis Marin (1523?), and of Adelantado Francisco de Montejo (1526-27); and shows hypothetical boundaries of the great kingdoms of Mayapan and Quiché, which fortunately for the Spaniards came to an end before their day.

ATTENTION has been drawn by Dr. G. A. Dorsey (*American Anthropologist*, x. p. 169) to the frequency of Wormian bones in the coronal suture in artificially deformed skulls of the Kwakiutl Indians of Vancouver Island. He explains their

occurrence by bandaging in early life, and he finds that the percentage of frequency becomes the greater as we ascend the scale of length of the cranium due to artificial elongation, and just in direct proportion to a deep well-defined groove behind the coronal suture. The long bones of the Kwakiutl and Salish Indians of British Columbia have also been studied by Dr. G. A. Dorsey in the same journal. The radio-humeral index is 75.5; the lengthening may be due to intermixture with Indians of the east or south. The tibio-femoral index is 79.1, the intermembral index is 70.7, and the femero-humeral index is 72.8. These indices approach very closely, and indeed often equal, those which have been determined for the Eskimos, the Samoyeds, and the Lapps.

ATTENTION has previously been drawn (*NATURE*, vol. liv. p. 404) to the good work in Indian anthropology that is being done by Mr. Edgar Thurston, the superintendent of the Madras Government Museum. The second volume of the Museum *Bulletin* opens with an account of the Badagas and Irulas of the Nilgiris, the Paniyans of Malabar and the Kuruba or Kurumba; there are numerous tables of measurements, and seventeen plates. The Paniyans are a dark-skinned tribe short in stature (1574 mm., 5 ft. 2 in.), dolichocephalic (74), with broad noses (min. 83.7, max. 108.6, av. 95.1), and curly hair. The common belief that they are of African origin is erroneous. They are wholly uneducated, and do not associate with other tribes. A short account is given of the customs and manner of living of this primitive Dravidian tribe. The other tribes mentioned by the author also exhibit Dravidian characters to a greater or less extent. In the interesting summary which closes this small but valuable memoir the author draws attention to the rapid modification of the natives through contact with the European, and to the need for immediate ethnographical investigations before it is too late. He says: "I was lately shocked by seeing a Toda boy studying for the third standard in Tamil, instead of tending the buffaloes of his mand. The Todas, whose natural drink is milk, now delight in bottled beer and a mixture of port wine and gin. Tiles and kerosine tins are employed instead of the primitive thatch. A Bengali babu, with close-cropped hair and bare head, clad in patent-leather boots, white socks, dhuti, and conspicuous unstarched shirt of English device; a Hindu or Parsi cricket eleven engaged against a European team; the increasing struggle for small-paid appointments under Government—these are a few examples of changes resulting from the refinement of modern civilisation."

THE first part of a Report by M. Ch. Rabot (International Commission on Glaciers) on the variation in the length of glaciers in the Arctic regions, has been published in the *Arch. Sci. Phys. et Nat.*, Geneva. All available evidence is here collected from many scattered sources, and though the evidence is admittedly imperfect, it enables some interesting conclusions to be drawn. There is no sign of a general retreat corresponding to that of the Alpine glaciers after 1850. In Greenland the ice seems to be stationary at a maximum now. In Iceland, the eighteenth century was marked by a general increase, interrupted by a partial decrease, only to be followed by a very extensive advance which has lasted through most of the nineteenth century. A slight retreat began in the north of the island about 1855-60, and twenty years later in the south; but this is not comparable with the marked retreat in the Alps. Grinnel Land and Jan Mayen are also dealt with in this instalment of a valuable report.

THE double number of *Spelunca*, which completes the third volume, maintains the high standard of its predecessors. Among other articles are one on the Kentucky Mammoth Cave, and one on the caves of County Leitrim.

MESSRS. A. GALLENKAMP AND CO., makers of chemical apparatus, wish it to be known that, in the new premises to which they have just removed, they propose to exhibit in their show-room examples of new instruments described in scientific periodicals, and of apparatus kept in stock.

A BIOGRAPHY and an account of the botanical labours of the late Prof. Julius Sachs, by Prof. Goebel, appears in the pages of *Flora*; and one of the late Fritz Müller, by Prof. Ludwig, in the *Botanisches Centralblatt*. Each memoir is accompanied by a copious bibliography.

ANOTHER new botanical journal is announced from America, the first number to appear on October 1. It is to be named *The Plant World*, and will be an illustrated monthly journal of popular botany. "It will," says the *Botanical Gazette*, "present the facts of plant-life in simple popular language, and aim to interest those who have no inclination for a systematic course of study. The purpose is to be scientific, but not technical." The editor will be Dr. J. F. Knowlton, of the U.S. National Museum.

AMONG papers on physiological botany recently received from America are "The Curvature of Roots" by Mr. D. T. McDougal, and "The Role of Water in Growth" by Mr. C. B. Davenport. In the former the author points out that the curvatures of stems are not due to the same causes as those of tendrils or of many roots. The curvature of roots is due to the excessive elongation of the internal layers of the cortex of the side which becomes convex. The development and organisation of irritability in roots has been widely different from that in stems. The organs of the irritable mechanism of roots exhibit a physiological rather than a morphological differentiation.

THE additions to the Zoological Society's Gardens during the past week include a Badger (*Meles taxus*) from Worcestershire, presented by Mrs. Cheape; a Macaque Monkey (*Macacus cynomolgus*) from India, presented by Mrs. B. Hudson; a Red and Yellow Macaw (*Ara chloroptera*) from South America, presented by Mr. J. W. Drysdale; a Peregrine Falcon (*Falco peregrinus*), British, presented by Major Hawkins Fisher; a Lesser Sulphur-crested Cockatoo (*Cacatua sulphurea*) from Moluccas, presented by Mr. John Paget; a Crowned Lemur (*Lemur coronatus*) from Madagascar, two Korin Gazelles (*Gazella rufifrons*, ♂ ♀) from Senegal; an Alexandrine Parrakeet (*Palzornis alexandri*) from India, deposited; two Common Sandpipers (*Tringoides hypoleucus*), European, purchased.

OUR ASTRONOMICAL COLUMN.

BOND'S COLLECTED WORKS.—It is stated in *Science* that, at the request of the daughters of George Bond, Prof. Holden, Director of the Lick Observatory, has undertaken to arrange the manuscript material in their hands in an orderly form. The work will be entitled "Memorials of William Cranch Bond, Director of the Harvard College Observatory, 1840-59, and of his son, George Phillips Bond, Director of the Harvard College Observatory, 1859-65," and will be published by Messrs. C. A. Murdock and Co., San Francisco, and by Messrs. Lemcke and Büchner, New York City. The book will be well illustrated. It is hoped, by the kindness of Prof. E. C. Pickering, to reproduce two fine steel engravings of the Great Comet of 1858 and of the nebula of Orion, from the plates of the *Annals* of the Harvard College Observatory.

ECLIPSE EXPEDITION OF THE LICK OBSERVATORY.—We learn from the Publications of the Astronomical Society of the Pacific, that the Lick Observatory expedition to observe the forthcoming solar eclipse will consist of Prof. Campbell and volunteer assistants. The expenses of the expedition will be met from a fund provided by the late Colonel C. F. Crocker.

NO. 1457, VOL. 56]

The programme will include spectroscopic and photographic work, and an equipment will be taken to obtain the following results, among others:—Photographs of the spectrum of the reversing layer; spectrum photographs having for their special object the determination of the velocity of rotation of the corona; photographs of the corona on a large scale (40 feet long), on the plan employed by Prof. Schaeberle in Chile; photographs of the corona with a portrait lens; photographic photometry of the corona.

A REMARKABLE BINARY STAR.—Recent observations leave practically no room for doubt that the close double star β 883 = Lalande 9091 (R.A. = 4h. 44m. 33s., Decl. + 10° 52', Mags. 7.8 and 8), has the shortest period of any known binary. The star was discovered by Mr. Burnham in 1879, and Schiaparelli made a number of measures of it between 1887 and 1895, and upon combining these observations with other measures, Dr. T. J. J. See was forced to the conclusion that the period was only a few years. Further considerations give support to this view, and now Dr. See (*Monthly Notices*, R.A.S., June 1897), from a discussion of the whole of the facts of observation, concludes that the period is only 5.5 years.

The elements of the orbit are given as follows:—

$$\begin{aligned} P &= 5.5 \text{ years} & a &= 0''.621 \\ T &= 1896.40 & \Omega &= 20^\circ 6' \\ e &= 0.760 & i &= 82^\circ 52' \\ & & \lambda &= 273^\circ 83' \end{aligned}$$

Apparent orbit:—

$$\begin{aligned} \text{Length of major axis} &= 0''.67 \\ \text{Length of minor axis} &= 0''.16 \\ \text{Angle of major axis} &= 19^\circ 5' \\ \text{Angle of periastron} &= 318^\circ 0' \\ \text{Distance of star from centre} &= 0''.07 \end{aligned}$$

Referring to this remarkable object, Dr. See says:—

"The discovery of an object revolving in a period of 5.5 years is an achievement of some philosophic significance in the history of double-star astronomy. In the time of Sir John Herschel the most rapid of known binaries was ζ Herculis, with a period of 35 years. Twenty years ago the remarkable object 42 Comæ Berenices had reduced the shortest period to about 25 years, and in 1887 δ Equulei brought it down to 11.5 years. κ Pegasi (β 989) has since been shown to revolve in a similar period.

In β 883 we have for the first time a visible binary with a period fairly approaching those of the spectroscopic binaries recently discovered, and we seem assured that at last a link has been found connecting the two classes of objects. It is probable that other stars will disclose even shorter periods, for there is no reason why there should not be close doubles with periods of a single year or less. It will be an interesting object of future research to fill in the intervening steps between visible binaries with periods of a few years and the spectroscopic binaries revolving in a few days or months.

"The more critical inquiry into the motion of close doubles will commend itself to the attention of double-star observers with great telescopes, and, on the other hand, it may be hoped that the study of the relative motion in line of sight of the components of binaries like β 883 will be taken up by some of our great observatories equipped with powerful spectroscopic appliances."

FORTHCOMING BOOKS OF SCIENCE.

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